

Limb, these Rays, being by the *Atmosphere* inflected, appear to the eye at E, as if they had come from the points, N and O; and because the Ray L has a greater inclination upon the inequality of the *Atmosphere* than I, therefore must it suffer a greater inflection, and consequently be further elevated above its true place, then the Ray I, which has a less inclination, will be elevated above its true place; whence it will follow, that the lower side appearing nearer the upper then really it is, and the two *lateral* sides, *viz.* the right and left side, suffering no sensible alteration from the inflection, at least what it does suffer, does rather increase the visible Diameter then diminish it, as I shall shew by and by, the Figure of the luminous body must necessarily appear somewhat *Elliptical*.

This will be more plain, if in the seventh *Figure* of th 37. *Scheme* we suppose AB to represent the sensible Horizon; CDEF, the body of the Sun really below it; GHIK, the same appearing above it, elevated by the inflection of the *Atmosphere*: For if, according to the best observation, we make the visible Diameter of the Sun to be about three or four and thirty minutes, and the Horizontal refraction according to *Ticho* be thereabout, or somewhat more, the lower limb of the Sun E, will be elevated to I; but because, by his account, the point C will be elevated but 29. minutes, as having not so great an inclination upon the inequality of the Air, therefore IG, which will be the apparent refracted perpendicular Diameter of the Sun, will be less then CG, which is but 29. minutes, and consequently six or seven minutes shorter then the unrefracted apparent Diameter. The parts, D and F, will be likewise elevated to H and K, whose refraction, by reason of its inclination, will be bigger then that of the point C, though less then that of E; therefore will the semidiameter IL, be shorter then LG, and consequently the under side of the appearing Sun more flat then the upper.

Now, because the Rays from the right and left sides of the Sun, &c. have been observ'd by *Ricciolo* and *Grimaldus*, to appear more distant one from another then really they are, though (by very many Observations that I have made for that purpose, with a very good *Telescope*, fitted with a divided Ruler) I could never perceive any great alteration, yet there being really some, it will not be amiss, to shew that this also proceeds from the refraction or inflection of the *Atmosphere*; and this will be manifest, if we consider the *Atmosphere* as a transparent Globe, or at least a transparent shell, encompassing an opacous Globe, which, being more dense then the *medium* encompassing it, refracts or inflects all the entering parallel Rays into a point or focus, so that wheresoever the Observator is plac'd within the *Atmosphere*, between the focus and the luminous body, the *lateral* Rays must necessarily be more converg'd towards his eye by the refraction or inflection, then they would have been without it; and therefore the Horizontal Diameter of the luminous body must necessarily be augmented.

This might be more plainly manifest to the eye by the sixth *Figure*; but because it would be somewhat tedious, and the thing being obvious enough

enough to be imagin'd by any one that attentively considers it, I shall rather omit it, and proceed to shew, that the mass of Air near the surface of the Earth, consists, or is made up, of parcels, which do very much differ from one another in point of density and rarity; and consequently the Rays of light that pass through them will be variously inflected, here one way, and there another, according as they pass so or so through those differing parts; and those parts being always in motion, either upwards or downwards, or to the right or left, or in some way compounded of these, they do by this their motion inflect the Rays, now this way, and presently that way.

This irregular, unequal and unconstant inflection of the Rays of light, is the reason why the limb of the *Sun*, *Moon*, *Jupiter*, *Saturn*, *Mars*, and *Venus*, appear to wave or dance; and why the body of the Stars appear to tremulate or twinkle, their bodies, by this means, being sometimes magnify'd, and sometimes diminished; sometimes elevated, otherwhiles depressed; now thrown to the right hand, and then to the left.

And that there is such a property or unequal distribution of parts, is manifest from the various degrees of heat and cold that are found in the Air; from whence will follow a differing density and rarity, both as to quantity and refraction; and likewise from the vapours that are interpos'd, (which, by the way, I imagine, as to refraction or inflection, to do the same thing, as if they were rarify'd Air; and that those vapours that ascend, are both lighter, and less dense, then the ambient Air which boys them up; and that those which descend, are heavier and more dense) The first of these may be found true, if you take a good thick piece of Glass, and heating it pretty hot in the fire, lay it upon such another piece of Glass, or hang it in the open Air by a piece of Wire, then looking upon some far distant Object (such as a Steeple or Tree) so as the Rays from that Object pass directly over the Glass before they enter your eye, you shall find such a tremulation and wavering of the remote Object, as will very much offend your eye: The like tremulous motion you may observe to be caus'd by the ascending steams of Water, and the like. Now, from the first of these it is manifest, that from the rarification of the parts of the Air, by heat, there is caus'd a differing refraction, and from the ascension of the more rarify'd parts of the Air, which are thrust up by the colder, and therefore more condens'd and heavie, is caus'd an undulation or wavering of the Object; for I think, that there are very few will grant, that Glass, by as gentle a heat as may be endur'd by ones hand, should send forth any of its parts in steams or vapours, which does not seem to be much wasted by that violent fire of the green Glass-house; but, if yet it be doubted, let Experiment be further made with that body that is accounted, by Chymists and others, the most ponderous and fix'd in the world; for by heating of a piece of Gold, and proceeding in the same manner, you may find the same effects.

This trembling and shaking of the Rays, is more sensibly caus'd by an actual flame, or quick fire, or any thing else heated glowing hot; as by a Candle, live Coal, red-hot Iron, or a piece of Silver, and the like: the same also appears very conspicuous, if you look at an Object betwixt which